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ABSTRACT

Intended for classroom use only, these unpublished notes contain computer lessons on descriptive statistics using SPSS-X Release 3.0 for VAX/UNIX. Statistical measures covered include Chi-square analysis; Spearman's rank correlation coefficient; Student's t-test with two independent samples; Student's t-test with a paired sample; One-way analysis of variance, with Tukey mean comparison; Two-way analysis of variance; and Pearson's product moment coefficient of correlation. (ALF)

****
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Nova University

Center for Computer and Information Sciences

ED352024

EXAMPLES OF DATA ANALYSIS

WITH SPSS-X

THOMAS W. MACFARLAND, Ed.D.

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EXAMPLES OF DATA ANALYSIS WITH SPSS-X

Thomas W. MacFarland, Ed.D.

Unpublished notes of the author
December, 1989

Test: Descriptive Statistics

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4
Page 48

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario: Determine mean, standard deviation, and other descriptive statistics for two data sets. To make this more useful, include the concept of missing data.

X	Y
4	1
2	6
1	2
0	2
1	3
	0
	3

Files:
1. mean-sd.dat
2. mean-sd.r01
3. mean-sd.o01

Command: At the Unix prompt (%), key:

%spssx <mean-sd.r01> mean-sd.o01

Outcome: Descriptive statistics for X include:

Mean = 1.600

SD = 1.517

Further analysis can be found in the output file.

Descriptive statistics for Y include:

Mean = 2.429

SD = 1.902

Addendum:

```
***********
mean-sd.dat
***********

4 1
2 6
1 2
0 2
1 3
9 0
9 3

***********
mean-sd.r01
***********

SET WIDTH = 80
DATA LIST FILE = 'mean-sd.dat' FIXED
     / X           1
       Y           3

variable lables
       X           "Criterion X"/
       Y           "Criterion Y".

MISSING VALUES X Y (9)

FREQUENCIES VARIABLES=X Y
     /STATISTICS All

***********
mean-sd.o01
***********

116 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 15:09:41     Nova University                VAX 8550        ULTRIX 2.3

 For ULTRIX 2.3          Nova University                    License Number 19439
 This software is functional through November 30, 1989.
```

Try the new SPSS-X Release 3.0 features:

* Interactive SPSS-X command execution
* Online Help
* Nonlinear Regression
* Time Series and Forecasting (TRENDS)
* Macro Facility

* Improvements in:
* REPORT
* TABLES
* Simplified Syntax
* Matrix I/O

See SPSS-X Users Guide, Third Edition for more information on these features.

```
   1  0  SET WIDTH = 80
   2  DATA LIST FILE = 'mean-sd.dat' FIXED
   3       / X           1
   4         Y           3
   5
```

THE COMMAND ABOVE READS 1 RECORDS FROM mean-sd.dat

VARIABLE	REC	START	END	FORMAT	WIDTH	DEC
X	1	1	1	F	1	0
Y	1	3	3	F	1	0

END OF DATALIST TABLE

```
   6  variable lables
   7         X          "Criterion X"/
   8         Y          "Criterion Y".
   9
  10  MISSING VALUES X Y (9)
  11
  12  FREQUENCIES VARIABLES=X Y
  13       /STATISTICS All
```

There are 198480 bytes of memory available.
The largest contiguous area has 198480 bytes.

***** MEMORY ALLOWS A TOTAL OF 7087 VALUES, ACCUMULATED ACROSS ALL VARIABLES.
      THERE ALSO MAY BE UP TO 886 VALUE LABELS FOR EACH VARIABLE.

X Criterion X

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT

0	1	14.3	20.0	20.0
1	2	28.6	40.0	60.0
2	1	14.3	20.0	80.0
4	1	14.3	20.0	100.0
9	2	28.6	MISSING	
TOTAL	7	100.0	100.0	

MEAN	1.600	STD ERR	.678	MEDIAN	1.000
MODE	1.000	STD DEV	1.517	VARIANCE	2.300
KURTOSIS	1.456	S E KURT	2.000	SKEWNESS	1.118
S E SKEW	.913	RANGE	4.000	MINIMUM	.000
MAXIMUM	4.000	SUM	8.000		

VALID CASES 5 MISSING CASES 2

- -

Y Criterion Y

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	1	14.3	14.3	14.3
	1	1	14.3	14.3	28.6
	2	2	28.6	28.6	57.1
	3	2	28.6	28.6	85.7
	6	1	14.3	14.3	100.0
	TOTAL	7	100.0	100.0	

MEAN	2.429	STD ERR	.719	MEDIAN	2.000
MODE	2.000	STD DEV	1.902	VARIANCE	3.619
KURTOSIS	1.795	S E KURT	1.587	SKEWNESS	.967
S E SKEW	.794	RANGE	6.000	MINIMUM	.000
MAXIMUM	6.000	SUM	17.000		

VALID CASES 7 MISSING CASES 0

PRECEDING TASK REQUIRED 0.15 SECONDS CPU TIME; 0.31 SECONDS ELAPSED

14

14 COMMAND LINES READ.
0 ERRORS DETECTED.

```
0 WARNINGS ISSUED.
0 SECONDS CPU TIME.
1 SECONDS ELAPSED TIME.
  END OF JOB.
```

Test: Chi-square Analysis (using all data)

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 671

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario: A study on stock movement, based on January indices as an indicator of yearly movement:

1. January = Up
   Feb.-Dec. = Up ..... n = 25 (Group 1 1)
2. January = Up
   Feb.-Dec. = Down ..... n = 10 (Group 1 2)
3. January = Down
   Feb.-Dec. = Up ..... n = 09 (Group 2 1)
4. January = Down
   Feb.-Dec. = Down ..... n = 09 (Group 2 2)

Ho: There is no difference between January stock prices and stock prices throughout the other 11 months.

Files:
1. z.dat
2. z.r01
3. z.o01

Command: At the Unix prompt (%), key:

```
%spssx <z.r01> z.o01
```

Outcome: Computed chi-square = 2.373

Criterion chi-square = 3.841 (alpha = .05, df = 1)

Computed chi-square (2.373) < Criterion chi-square (3.841)

Accept the Null Hypothesis ..... there is no difference between January stock prices and stock prices throughout

the other 11 months.

Addendum:

```
*****
z.dat
*****

01 1 1
02 1 1
03 1 1
04 1 1
05 1 1
06 1 1
07 1 1
08 1 1
09 1 1
10 1 1
11 1 1
12 1 1
13 1 1
14 1 1
15 1 1
16 1 1
17 1 1
18 1 1
19 1 1
20 1 1
21 1 1
22 1 1
23 1 1
24 1 1
25 1 1
26 1 2
27 1 2
28 1 2
29 1 2
30 1 2
31 1 2
32 1 2
33 1 2
34 1 2
35 1 2
36 2 1
37 2 1
38 2 1
39 2 1
40 2 1
41 2 1
42 2 1
42 2 1
```

```
43 2 1
44 2 2
45 2 2
46 2 2
47 2 2
48 2 2
49 2 2
50 2 2
51 2 2
52 2 2

*****
z.r01
*****

SET WIDTH = 80
DATA LIST FILE = 'z.dat' FIXED
     / Year        01
       January     04
       Other_11    06

variable lables
       Year        "Years, from 1927-1981"/
       January     "Stock Movement during January"/
       Other_11    "Stock Movement during Feb.-Dec.".

value labels
       January    1 'Up' 2 'Down'/
       Other_11   1 'Up' 2 'Down'.

CROSSTABS TABLES = January by Other_11
     /STATISTICS=CHISQ

*****
z.o01
*****

114 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 23:04:06     Nova University                VAX 8550        ULTRIX 2.3


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 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O
```

See SPSS-X Users Guide, Third Edition for more information on these features.

```
  1  0  SET WIDTH = 80
  2  DATA LIST FILE = 'z.dat' FIXED
  3       / Year        01
  4         January     04
  5         Other_11    06
  6
```

THE COMMAND ABOVE READS 1 RECORDS FROM z.dat

VARIABLE	REC	START	END	FORMAT	WIDTH	DEC
YEAR	1	1	1	F	1	0
JANUARY	1	4	4	F	1	0
OTHER_11	1	6	6	F	1	0

END OF DATALIST TABLE

```
  7  variable lables
  8         Year        "Years, from 1927-1981"/
  9         January     "Stock Movement during January"/
 10         Other_11    "Stock Movement during Feb.-Dec.".
 11
 12  value labels
 13         January     1 'Up' 2 'Down'/
 14         Other_11    1 'Up' 2 'Down'.
 15
 16  CROSSTABS TABLES = January by Other_11
 17       /STATISTICS=CHISQ
```

There are 198368 bytes of memory available.
The largest contiguous area has 198368 bytes.

 ***** GIVEN WORKSPACE ALLOWS FOR 5509 CELLS WITH   2 DIMENSIONS FOR CROSSTA

114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX Page
23:04:07 Nova University VAX 8550 ULTRIX 2.3

- - - - - - - - - - - C R O S S T A B U L A T I O N O F - - - - - - - - - - -
   JANUARY   Stock Movement during January
BY OTHER_11 Stock Movement during Feb.-Dec.
- PAGE 1 OF 1

```
                 OTHER_11
        COUNT  I
               IUp        Down       ROW
               I                    TOTAL
```

JANUARY		1	2	
Up	1	25	10	35
				66.0
Down	2	9	9	18
				34.0
	COLUMN TOTAL	34	19	53
		64.2	35.8	100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
1.53307	1	0.2157	6.453	NONE
2.37340	1	0.1234	(BEFORE YATES CORRECTION)	

NUMBER OF MISSING OBSERVATIONS = 0

114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX Page
23:04:07 Nova University VAX 8550 ULTRIX 2.3

PRECEDING TASK REQUIRED 0.22 SECONDS CPU TIME; 0.26 SECONDS ELAPSED

18

```
    18 COMMAND LINES READ.
     0 ERRORS DETECTED.
     0 WARNINGS ISSUED.
     0 SECONDS CPU TIME.
     1 SECONDS ELAPSED TIME.
       END OF JOB.
```

Test: Chi-square Analysis (using WEIGHT, to avoid excessive keying)

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 667

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario: A study on the incidence of obesity in children and obesity of parents (either one or both parents):

1. Parent = Obese
   Child = Obese ..... n = 34 (Group 1 1)

2. Parent = Obese
   Child = Nonobese ... n = 29 (Group 1 2)

3. Parent = Nonobese
   Child = Obese ..... n = 16 (Group 2 1)

4. Parent = Nonobese
   Child = Nonobese ... n = 21 (Group 2 2)

Ho: There is no difference in the incidence of obesity among children and the incidence of obesity with their respective parents.

Files:
1. zz.dat
2. zz.r01
3. zz.o01

Command: At the Unix prompt (%), key:

```
%spssx <zz.r01> z.o01
```

Outcome: Computed chi-square = 1.072

Criterion chi-square = 3.841 (alpha = .05, df = 1)

Computed chi-square (1.072) < Criterion chi-square (3.841)

Accept the Null Hypothesis ..... there is no difference

between the incidence of obesity among children and the incidence of obesity with their respective parents.

Addendum:

```
******
zz.dat
******

34 1 1
29 1 2
16 2 1
21 2 2

******
zz.r01
******

SET WIDTH = 80
DATA LIST FILE = 'zz.dat' FIXED
     / Freq      01-02
       Parent      04
       Child       06

WEIGHT by Freq

variable labels
       Parent      "Parent, either one or both"/
       Child       "Child".

value labels
       Parent      1 'Obese'
                   2 'Nonobese'.
     /
       Child       1 'Obese'
                   2 'Nonobese'.

CROSSTABS TABLES = Parent by Child
 /STATISTICS=CHISQ

******
zz.o01
******

115 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 13:15:18     Nova University                VAX 8550        ULTRIX 2.3

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* Interactive SPSS-X command execution
* Online Help
* Nonlinear Regression
* Time Series and Forecasting (TRENDS)
* Macro Facility

* Improvements in:
* REPORT
* TABLES
* Simplified Syntax
* Matrix I/O

See SPSS-X Users Guide, Third Edition for more information on these features.

```
  1  0  SET WIDTH = 80
  2  DATA LIST FILE = 'zz.dat' FIXED
  3       / Freq      01-02
  4         Parent       04
  5         Child        06
  6
```

THE COMMAND ABOVE READS 1 RECORDS FROM zz.dat

VARIABLE	REC	START	END	FORMAT	WIDTH	DEC
FREQ	1	1	2	F	2	0
PARENT	1	4	4	F	1	0
CHILD	1	6	6	F	1	0

END OF DATALIST TABLE

```
  7  WEIGHT by Freq
  8
  9  variable labels
 10         Parent      "Parent, either one or both"/
 11         Child       "Child".
 12
 13  value labels
 14         Parent      1 'Obese'
 15                     2 'Nonobese'.
 16       /
 17         Child       1 'Obese'
 18                     2 'Nonobese'.
 19
 20  CROSSTABS TABLES = Parent by Child
 21   /STATISTICS=CHISQ
```

There are 198368 bytes of memory available.
The largest contiguous area has 198368 bytes.

 ***** GIVEN WORKSPACE ALLOWS FOR 5509 CELLS WITH   2 DIMENSIONS FOR CROSSTA

13:15:19 Nova University VAX 8550 ULTRIX 2.3

- - - - - - - - - - - C R O S S T A B U L A T I O N O F - - - - - - - - - -
PARENT Parent, either one or both
BY CHILD Child
- PAGE 1 OF 1

		CHILD		
COUNT	I			
	IObese	Nonobese	ROW TOTAL	
	I			
	I 1I	2I		
PARENT	--------+--------+--------+			
1	I 34	I 29	I 63	
Obese	I	I	I 63.0	
	+--------+--------+			
2	I 16	I 21	I 37	
Nonobese	I	I	I 37.0	
	+--------+--------+			
COLUMN TOTAL	50 50.0	50 50.0	100 100.0	

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
0.68640	1	0.4074	18.500	NONE
1.07250	1	0.3004	(BEFORE YATES CORRECTION)	

NUMBER OF MISSING OBSERVATIONS = 0

115 Nov 89 SPSS-X Release 3.0 for VAX/UNIX Page
13:15:19 Nova University VAX 8550 ULTRIX 2.3

PRECEDING TASK REQUIRED 0.13 SECONDS CPU TIME; 0.18 SECONDS ELAPSED

22

22 COMMAND LINES READ.
0 ERRORS DETECTED.
0 WARNINGS ISSUED.
0 SECONDS CPU TIME.
1 SECONDS ELAPSED TIME.
END OF JOB.

Test: Spearman's Rank Correlation Coefficient

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 619

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario:

Type of Wine	Judge 1 Rating	Judge 2 Rating
1	6	5
2	5	6
3	1	2
4	3	1
5	2	4
6	4	3

Files:

1. yy.dat
2. yy.r01
3. yy.o01

Command: At the Unix prompt (%), key:

```
%spssx <yy.r01> yy.o01
```

Outcome: Computed r = .657

Criterion r = .829 (alpha = .05, n = 6)

Computed r (.657) < Criterion r (.829)

By casual observation, it would appear that there is a moderate association between the ratings of Judge 1 and Judge 2 (r > .60).

Yet, r is not significant. Recall, however, that correlation is very sensitive to n, especially when n is low, such as n = 6 in this example.

Addendum:

******

```
yy.dat
******

1 6 5
2 5 6
3 1 2
4 3 1
5 2 4
6 4 3

******
yy.r01
******

SET WIDTH = 80
DATA LIST FILE = 'yy.dat' FIXED
     / Brand          01
       Judge_1        03
       Judge_2        05

variable lables
     Brand       "Type of Wine"/
     Judge_1     "Judge #1"/
     Judge_2     "Judge #2".

NONPAR CORR VARIABLES=Judge_1 with Judge_2

******
yy.o01
******

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 13:08:53     Nova University                VAX 8550        ULTRIX 2.3


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 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O

 See SPSS-X Users Guide, Third Edition for more information on these features.

    1  0  SET WIDTH = 80
    2  DATA LIST FILE = 'yy.dat' FIXED
    3       / Brand          01
    4         Judge_1        03
```

```
   5         Judge_2        05
   6

THE COMMAND ABOVE READS    1 RECORDS FROM yy.dat

          VARIABLE    REC  START     END          FORMAT   WIDTH   DEC

          BRAND         1      1       1          F            1     0
          JUDGE_1       1      3       3          F            1     0
          JUDGE_2       1      5       5          F            1     0

END OF DATALIST TABLE


   7  variable lables
   8        Brand       "Type of Wine"/
   9        Judge_1     "Judge #1"/
  10        Judge_2     "Judge #2".
  11
  12  NONPAR CORR VARIABLES=Judge_1 with Judge_2

There are 198384 bytes of memory available.
The largest contiguous area has 198384 bytes.

 ***** WORKSPACE ALLOWS FOR    9916 CASES FOR NONPARAMETRIC CORRELATION PROBLEM

114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                              Page
 13:08:54  Nova University                VAX 8550        ULTRIX 2.3

- - -  S P E A R M A N   C O R R E L A T I O N   C O E F F I C I E N T S  - - -

              JUDGE_2


JUDGE_1          .6571
              N(    6)
              SIG .078


" . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED.
114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                              Page
 13:08:54  Nova University                VAX 8550        ULTRIX 2.3

 PRECEDING TASK REQUIRED       0.07 SECONDS CPU TIME;       0.10 SECONDS ELAPSED

   13

     13 COMMAND LINES READ.
      0 ERRORS DETECTED.
```

```
0 WARNINGS ISSUED.
0 SECONDS CPU TIME.
1 SECONDS ELAPSED TIME.
  END OF JOB.
```

Test: Student's t-test with two independent samples

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 423

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario:

Group 1	Group 2
1.2	4.2
3.1	2.7
1.7	3.6
2.8	3.9
3.0	

Files:
1. x.dat
2. x.r01
3. x.o01

Command: At the Unix prompt (%), key:

```
%spssx <x.r01> x.o01
```

Outcome: Computed t = -2.39

Criterion t = -1.895 (alpha = .05, df = 7)

Computed t (-2.39) > Criterion t (-1.895)

Reject Null Hypothesis ... differences are significant

Group 2 is "more" than Group 1

Addendum:

*****
x.dat

```
*****

1 1.2
1 3.1
1 1.7
1 2.8
1 3.0
2 4.2
2 2.7
2 3.6
2 3.9

*****
x.r01
*****

SET WIDTH = 80
DATA LIST FILE = 'x.dat' FIXED
     / Group_ID      01
       Datum      03-05

variable labels
       Group_ID    "Group ID for the Study"/
       Datum       "Measured Score for Each Subject".

value labels
       Group_ID    1 'Group 1'
                   2 'Group 2'.

T-TEST GROUPS=Group_ID
      /VARIABLES=Datum


*****
x.o01
*****

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 15:52:55     Nova University                VAX 8550          ULTRIX 2.3


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 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O
```

See SPSS-X Users Guide, Third Edition for more information on these features.

```
  1  0  SET WIDTH = 80
  2  DATA LIST FILE = 'x.dat' FIXED
  3       / Group_ID      01
  4         Datum      03-05
  5

THE COMMAND ABOVE READS    1 RECORDS FROM x.dat

          VARIABLE   REC  START    END          FORMAT  WIDTH  DEC

          GROUP_ID     1      1      1          F           1    0
          DATUM        1      3      5          F           3    0

END OF DATALIST TABLE


  6  variable labels
  7         Group_ID   "Group ID for the Study"/
  8         Datum      "Measured Score for Each Subject".
  9
 10  value labels
 11         Group_ID   1 'Group 1'
 12                    2 'Group 2'.
 13
 14  T-TEST GROUPS=Group_ID
 15        /VARIABLES=Datum

There are 198464 bytes of memory available.
The largest contiguous area has 197952 bytes.

THE T-TEST PROBLEM REQUIRES       56 BYTES OF WORKSPACE

113 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 15:52:56  Nova University                VAX 8550        ULTRIX 2.3


- - - - - - - - - - - - - - - - - - - - T - T E S T- - - - - - - - - - - - - - - - - -

GROUP 1 - GROUP_ID EQ          1
GROUP 2 - GROUP_ID EQ          2


VARIABLE          NUMBER                    STANDARD    STANDARD
                 OF CASES      MEAN        DEVIATION     ERROR
-----------------------------------------------------------------
DATUM     Measured Score for Each Subject
      GROUP 1        5       2.3600         0.856       0.383

      GROUP 2        4       3.6000         0.648       0.324
```

		*	POOLED VARIANCE ESTIMATE			*	SEPARATE VARIANCE ESTIMATE		
F VALUE	2-TAIL PROB.	*	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	*	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
1.75	0.675	*	-2.39	7	0.048	*	-2.47	7.00	0.043

113 Nov 89 SPSS-X Release 3.0 for VAX/UNIX Page
15:52:56 Nova University VAX 8550 ULTRIX 2.3

PRECEDING TASK REQUIRED 0.12 SECONDS CPU TIME; 0.17 SECONDS ELAPSED

16

```
  16 COMMAND LINES READ.
   0 ERRORS DETECTED.
   0 WARNINGS ISSUED.
   0 SECONDS CPU TIME.
   1 SECONDS ELAPSED TIME.
     END OF JOB.
```

Test: Student's t-test with a paired sample

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 432

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario:

	Starting Salary	
Pair	Male	Female
01	14300	13800
02	16500	16600
03	15400	14800
04	13500	13500
05	18500	17600
06	12800	13000
07	14500	14200
08	16200	15100
09	13400	13200
10	14200	13500

Files:

1. xx.dat
2. xx.r01
3. xx.o01

Command: At the Unix prompt (%), key:

```
%spssx <xx.r01> xx.o01
```

Outcome: Computed t = 2.91

Criterion t = 1.833 (alpha = .05, df = 9)

Computed t (2.91) > Criterion t (1.833)

Reject Null Hypothesis ... differences are significant

Males had a higher starting salary than females

Addendum:

```
******
xx.dat
******

01 14300 13800
02 16500 16600
03 15400 14800
04 13500 13500
05 18500 17600
06 12800 13000
07 14500 14200
08 16200 15100
09 13400 13200
10 14200 13500

******
xx.r01
******

SET WIDTH = 80
DATA LIST FILE = 'xx.dat' FIXED
     / Pair        01-02
       Male_$      04-08
       Female_$    10-14

variable labels
       Pair        "Paired Group ID Number"/
       Male_$      "Male Starting Salary"/
       Female_$    "Female Starting Salary".

T-TEST PAIRS=Male_$,Female_$

******
xx.o01
******

113 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 16:39:03     Nova University                VAX 8550        ULTRIX 2.3


 For ULTRIX 2.3          Nova University                    License Number 19439
 This software is functional through November 30, 1989.

 Try the new SPSS-X Release 3.0 features:

 * Interactive SPSS-X command execution          * Improvements in:
 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O
```

See SPSS-X Users Guide, Third Edition for more information on these features.

```
  1  0  SET WIDTH = 80
  2  DATA LIST FILE = 'xx.dat' FIXED
  3       / Pair        01-02
  4         Male_$      04-08
  5         Female_$    10-14
  6
```

THE COMMAND ABOVE READS 1 RECORDS FROM xx.dat

VARIABLE	REC	START	END	FORMAT	WIDTH	DEC
PAIR	1	1	2	F	2	0
MALE_$	1	4	8	F	5	0
FEMALE_$	1	10	14	F	5	0

END OF DATALIST TABLE

```
  7  variable labels
  8         Pair        "Paired Group ID Number"/
  9         Male_$      "Male Starting Salary"/
 10         Female_$    "Female Starting Salary".
 11
 12  T-TEST PAIRS=Male_$,Female_$
```

There are 198376 bytes of memory available.
The largest contiguous area has 198024 bytes.

THE T-TEST PROBLEM REQUIRES 64 BYTES OF WORKSPACE

113 Nov 89 SPSS-X Release 3.0 for VAX/UNIX Page
16:39:04 Nova University VAX 8550 ULTRIX 2.3

- T - T E S T - - - - - - - - - - - - - - - - - -

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR
MALE_$	Male Starting Salary			
	10	14930.0000	1734.647	548.544
	10	14530.0000	1526.834	482.827
FEMALE_$	Female Starting Salary			

(DIFFERENCE) MEAN	STANDARD DEVIATION	STANDARD ERROR	* CORR.	2-TAIL PROB. *	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
400.0000	434.613	137.437	* 0.972	0.000 *	2.91	9	0.017

```
113 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 16:39:04  Nova University                VAX 8550        ULTRIX 2.3

 PRECEDING TASK REQUIRED       0.08 SECONDS CPU TIME;       0.23 SECONDS ELAPSED

   13

      13 COMMAND LINES READ.
       0 ERRORS DETECTED.
       0 WARNINGS ISSUED.
       0 SECONDS CPU TIME.
       1 SECONDS ELAPSED TIME.
         END OF JOB.
```

Test: Oneway Analysis of Variance, with Tukey Mean Comparison

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 503

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario: A study on the observation that the ability to tolerate pain (i.e., pain threshold) may be related to hair color (the measured score).

Light Blond	Dark Blond	Light Brunette	Dark Brunette
62	63	42	32
60	57	50	39
71	52	41	51
55	41	37	30
48	43		35

Note. Notice how group n is not equal.

Ho: There is no difference in the ability to tolerate pain between people with various hair colors (e.g., light blond, dark blond, light brunette, dark brunette).

Files:
1. anova1.dat
2. anova1.r01
3. anova1.o01

Command: At the Unix prompt (%), key:

```
%spssx <anova1.r01> anova1.o01
```

Outcome: Computed F = 6.79

Criterion F = 3.49 (alpha = .05, df = 3,15)

Computed F (6.79) > Criterion F (2.49)

Reject the Null Hypothesis ..... there are differences between groups.

Consult the mean comparison (e.g., Tukey, LSD) part of the outcome file to better understand differences between groups:

(*) DENOTES PAIRS OF GROUPS SIGNIFICANTLY DIFFERENT AT THE 0.050 LEVEL

Mean	Group	Grp 4	Grp 3	Grp 2	Grp 1
37.4000	Grp 4				
42.5000	Grp 3				
51.2000	Grp 2				
59.2000	Grp 1	*	*		

Using traditional methodology, you could also visually present mean comparisons by using underscores:

Group 4	Group 3	Group 2	Group 1
Dark Brunette	Light Brunette	Dark Blond	Light Blond
37.40	42.50	51.20	59.20

Addendum:

```
**********
anova1.dat
**********

1 62
1 60
1 71
1 55
1 48
2 63
2 57
2 52
2 41
```

```
2 43
3 42
3 50
3 41
3 37
4 32
4 39
4 51
4 30
4 35

**********
anova1.r01
**********

SET WIDTH = 80
DATA LIST FILE = 'anova1.dat' FIXED
     / Group         01
       Score      03-04

variable lables
     Group       "Group, Based on Hair Color"/
     Score       "Pain Threshold Score".

value labels
     Group 1 'Light Blond'
           2 'Dark Blond'
           3 'Light Brunette'
           4 'Dark Brunette'.

ONEWAY Score by Group (1,4)
 /RANGES=TUKEY

**********
anova1.o01
**********

115 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 22:25:44     Nova University                VAX 8550          ULTRIX 2.3


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 * Interactive SPSS-X command execution          * Improvements in:
 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O
```

See SPSS-X Users Guide, Third Edition for more information on these features.

```
   1  0  SET WIDTH = 80
   2  DATA LIST FILE = 'anova1.dat' FIXED
   3       / Group         01
   4         Score      03-04
   5

THE COMMAND ABOVE READS    1 RECORDS FROM anova1.dat

          VARIABLE   REC  START    END          FORMAT  WIDTH  DEC

          GROUP        1      1      1          F           1    0
          SCORE        1      3      4          F           2    0

END OF DATALIST TABLE


   6  variable lables
   7       Group       "Group, Based on Hair Color"/
   8       Score       "Pain Threshold Score".
   9
  10  value labels
  11       Group 1 'Light Blond'
  12             2 'Dark Blond'
  13             3 'Light Brunette'
  14             4 'Dark Brunette'.
  15
  16  ONEWAY Score by Group (1,4)
  17   /RANGES=TUKEY

       448 BYTES OF MEMORY REQUIRED FOR ONEWAY PROCEDURE.

 There are 198472 bytes of memory available.
 The largest contiguous area has 198472 bytes.
115 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 22:25:44  Nova University              VAX 8550        ULTRIX 2.3

- - - - - - - - - - - - - - - - O N E W A Y - - - - - - - - - - - - - - - - -

     Variable  SCORE      Pain Threshold Score
  By Variable  GROUP      Group, Based on Hair Color

                          ANALYSIS OF VARIANCE

                                  SUM OF          MEAN              F      F
       SOURCE              D.F.   SQUARES         SQUARES         RATIO  PROB.

BETWEEN GROUPS                3   1360.7263       453.5754        6.7914  .0041
```

```
WITHIN GROUPS              15      1001.8000        66.7867

TOTAL                      18      2362.5263
```



```
- - - - - - - - - - - - - - - - O N E W A Y - - - - - - - - - - - - - - - - -

     Variable  SCORE      Pain Threshold Score
  By Variable  GROUP      Group, Based on Hair Color

MULTIPLE RANGE TEST

TUKEY-HSD PROCEDURE
RANGES FOR THE 0.050 LEVEL -

          4.07    4.07    4.07

THE RANGES ABOVE ARE TABLE RANGES.
THE VALUE ACTUALLY COMPARED WITH MEAN(J)-MEAN(I) IS..
        5.7787 * RANGE * DSQRT(1/N(I) + 1/N(J))

   (*) DENOTES PAIRS OF GROUPS SIGNIFICANTLY DIFFERENT AT THE 0.050 LEVEL

                          G G G G
                          r r r r
                          p p p p

     Mean       Group     4 3 2 1

    37.4000     Grp 4
    42.5000     Grp 3
    51.2000     Grp 2
    59.2000     Grp 1     * *
```



```
PRECEDING TASK REQUIRED       0.18 SECONDS CPU TIME;       0.29 SECONDS ELAPSED

  18

    18 COMMAND LINES READ.
     0 ERRORS DETECTED.
     0 WARNINGS ISSUED.
     0 SECONDS CPU TIME.
```

```
1 SECONDS ELAPSED TIME.
  END OF JOB.
```

Test: Twoway Analysis of Variance

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 533

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario: A study on the effect of type of golf club and type of golf ball on distance of hit.

		Brand			
		A	B	C	D
Club	Driver	226.4	238.3	240.5	219.8
		232.6	231.7	246.9	228.7
		234.0	227.7	240.3	232.9
		220.7	237.2	244.7	237.6
	Five-Iron	163.8	184.4	179.0	157.8
		179.4	180.6	168.0	161.8
		168.6	179.5	165.2	162.1
		173.4	186.2	156.5	160.3

Ho: There is no difference between golf clubs (driver and five-iron) and golf balls (Brands A, B, C, and D) and the distance of hit.

Files:
1. anova2.dat
2. anova2.r01
3. anova2.o01

Command: At the Unix prompt (%), key:

```
%spssx <anova2.r01> anova2.o01
```

Outcome:

Club ..... F = 936.752 (Significance .00)

Ball ..... F = 7.791 (Significance .001)

Club by Ball
Interaction ... F = 7.452 (Significance .001)

Reject the Null Hypothesis ..... there are differences between clubs, balls, and interaction of clubs and balls.

Bonferroni methodology would be needed to further analyze where differences and similarities exist.

Addendum:

```
**********
anova2.dat
**********

1 1 226.4
1 1 232.6
1 1 234.0
1 1 220.7
1 2 238.3
1 2 231.7
1 2 227.7
1 2 237.2
1 3 240.5
1 3 246.9
1 3 240.3
1 3 244.7
1 4 219.8
1 4 228.7
1 4 232.9
1 4 237.6
2 1 163.8
2 1 179.4
2 1 168.6
2 1 173.4
2 2 184.4
2 2 180.6
2 2 179.5
2 2 186.2
2 3 179.0
2 3 168.0
2 3 165.2
```

```
2 3 156.5
2 4 157.8
2 4 161.8
2 4 162.1
2 4 160.3

**********
anova2.r01
**********

SET WIDTH = 80
DATA LIST FILE = 'anova2.dat' FIXED
     / Club          01
       Ball          03
       Distance    05-09

VARIABLE LABELS
       Club          "Type of Golf Club"/
       Ball          "Type of Golf Ball"/
       Distance      "Distance of Hit".

VALUE LABELS
       Club          1 'Driver'
                     2 'Five-Iron'

     / Ball          1 'Brand A'
                     2 'Brand B'
                     3 'Brand C'
                     4 'Brand D'.

ANOVA Distance by Club (01,02) Ball (01,04)

**********
anova2.o01
**********

16 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 13:13:07    Nova University                    VAX 8550          ULTRIX 2.3


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 Try the new SPSS-X Release 3.0 features:

 * Interactive SPSS-X command execution          * Improvements in:
 * Online Help                                    *   REPORT
 * Nonlinear Regression                           *   TABLES
 * Time Series and Forecasting (TRENDS)           *   Simplified Syntax
 * Macro Facility                                 *   Matrix I/O

 See SPSS-X Users Guide, Third Edition for more information on these features.
```

```
  1  0  SET WIDTH = 80
  2  DATA LIST FILE = 'anova2.dat' FIXED
  3       / Club          01
  4         Ball          03
  5         Distance  05-09
  6

THE COMMAND ABOVE READS    1 RECORDS FROM anova2.dat

          VARIABLE   REC  START     END          FORMAT  WIDTH  DEC

          CLUB         1      1       1          F           1    0
          BALL         1      3       3          F           1    0
          DISTANCE     1      5       9          F           5    0

END OF DATALIST TABLE


  7  VARIABLE LABELS
  8         Club         "Type of Golf Club"/
  9         Ball         "Type of Golf Ball"/
 10         Distance     "Distance of Hit".
 11
 12  VALUE LABELS
 13         Club         1 'Driver'
 14                      2 'Five-Iron'
 15
 16       / Ball         1 'Brand A'
 17                      2 'Brand B'
 18                      3 'Brand C'
 19                      4 'Brand D'.
 20
 21  ANOVA Distance by Club (01,02) Ball (01,04)

 'ANOVA' PROBLEM REQUIRES      992 BYTES OF MEMORY.
116 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 13:13:08  Nova University              VAX 8550        ULTRIX 2.3

          * * *  A N A L Y S I S   O F   V A R I A N C E  * * *

              DISTANCE Distance of Hit
          by  CLUB     Type of Golf Club
              BALL     Type of Golf Ball


Source of Variation                Sum of Squares     DF      Mean Square         F    Sig of F

Main Effects                         32893.847         4      8223.462       240.031    .000
   CLUB                              32093.111         1     32093.111       936.752    .00
```

BALL	800.736	3	266.912	7.791	.001
2-Way Interactions	765.961	3	255.320	7.452	.001
CLUB BALL	765.961	3	255.320	7.452	.001
Explained	33659.809	7	4808.544	140.354	.000
Residual	822.240	24	34.260		
Total	34482.049	31	1112.324		

32 cases were processed.
0 cases (.0 pct) were missing.

PRECEDING TASK REQUIRED 0.34 SECONDS CPU TIME; 0.37 SECONDS ELAPSED

22

22 COMMAND LINES READ.
0 ERRORS DETECTED.
0 WARNINGS ISSUED.
1 SECONDS CPU TIME.
1 SECONDS ELAPSED TIME.
END OF JOB.

Test: Pearson's Product Moment Coefficient of Correlation

Source: McClave, James T., and Frank H. Dietrich, II. STATISTICS, 4th edition. San Francisco, California: Dellen Publishing Company, 1988. ISBN 0-02-379260-4 Page 712

Software: SPSS-X Release 3.0 for VAX/UNIX

Scenario:

Year	Number of Salespeople	Dollar Value of Sales
1978	15	135000
1979	18	163000
1980	24	233000
1981	22	241000
1982	25	263000
1983	29	293000
1984	30	341000
1985	32	326000
1986	35	363000
1987	38	415000

Files:

1. y.dat
2. y.r01
3. y.o01

Command: At the Unix prompt (%), key:

```
%spssx <y.r01> y.o01
```

Outcome: Computed r = .987

Criterion r = .549 (alpha = .05, n = 10)

Computed r (.987) > Criterion r (.549)

Reject the Null Hypothesis ..... the association between x (Number of Salespeople) and y (Dollar Value of Sales) is significant.

That is to say, as the number of salespeople increases the dollar value of sales also increases.

Addendum:

```
*****
y.dat
*****

1978 15 135000
1979 18 163000
1980 24 233000
1981 22 241000
1982 25 263000
1983 29 293000
1984 30 341000
1985 32 326000
1986 35 363000
1987 38 415000

*****
y.r01
*****

SET WIDTH = 80
DATA LIST FILE = 'y.dat' FIXED
     / Year        01-04
       Number      06-07
       Sales       09-14

variable lables
       Year        "Year"/
       Number      "Number of Salespeople"/
       Sales       "Total Sales".

CORRELATION Number with Sales

*****
y.o01
*****

114 Nov 89    SPSS-X Release 3.0 for VAX/UNIX
 12:47:49     Nova University                VAX 8550        ULTRIX 2.3


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 * Interactive SPSS-X command execution          * Improvements in:
 * Online Help                                   *   REPORT
 * Nonlinear Regression                          *   TABLES
 * Time Series and Forecasting (TRENDS)          *   Simplified Syntax
 * Macro Facility                                *   Matrix I/O
```

See SPSS-X Users Guide, Third Edition for more information on these features.

```
   1  0  SET WIDTH = 80
   2  DATA LIST FILE = 'y.dat' FIXED
   3       / Year        01-04
   4         Number      06-07
   5         Sales       09-14
   6
```

```
THE COMMAND ABOVE READS    1 RECORDS FROM y.dat

          VARIABLE   REC  START    END          FORMAT  WIDTH  DEC

          YEAR         1      1      4          F           4    0
          NUMBER       1      6      7          F           2    0
          SALES        1      9     14          F           6    0

END OF DATALIST TABLE
```

```
   7  variable lables
   8         Year        "Year"/
   9         Number      "Number of Salespeople"/
  10         Sales       "Total Sales".
  11
  12  CORRELATION Number with Sales

*****PEARSON CORR PROBLEM REQUIRES      80 BYTES WORKSPACE *****

114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 12:47:51  Nova University                VAX 8550        ULTRIX 2.3

- - - -  P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S  - - -

              SALES

NUMBER          .9870
               (   10)
               P= .000

(COEFFICIENT / (CASES) / 1-TAILED SIG)

" . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED
114 Nov 89 SPSS-X Release 3.0 for VAX/UNIX                          Page
 12:47:51  Nova University                VAX 8550        ULTRIX 2.3
```

```
RECEDING TASK REQUIRED          0.08 SECONDS CPU TIME;          0.75 SECONDS ELAPSED

 13

   13 COMMAND LINES READ.
    0 ERRORS DETECTED.
    0 WARNINGS ISSUED.
    0 SECONDS CPU TIME.
    2 SECONDS ELAPSED TIME.
      END OF JOB.
```